Chapter - 2

Maryland's Lower Eastern Shore - Resource Assessment

1. Maryland's Lower Eastern Shore

The Lower Eastern Shore of Maryland, as described in this assessment, consists of 5 Maryland Counties (Caroline, Dorchester, Somerset, Wicomico, and Worcester) located on the Delmarva Peninsula. The region is surrounded on two sides by the Atlantic Ocean and the Chesapeake Bay. It is bounded by the State of Delaware on the North and connected to 2 Virginia counties on the South (See Figure 2). Part of the Atlantic Coastal Plain, it is a mix of lowland flats, fresh-water swamps, salt marshes, forested and non-forested wetlands and uplands. Elevations run from sea level to a high of only about 75 feet above sea level, and topography is flat to gently sloping. The climate is temperate, semi-continental and fairly uniform. Summers are hot and humid, with periods of drought common; winters are fairly mild, but can be marked by cold, harsh winds. Occasional Atlantic hurricanes and associated extreme weather disturbances may impact forest ecosystems, but they are rare. The average growing season ranges from 180 to 232 days per year depending on the area and water availability.

Table 2, and Figure 2 show that land use patterns within the five lower shore counties are dominated by, water, wetlands, forests and farmland. Taken together, water areas and wetlands make up almost 40 percent of the area within the boundaries of the region.

Table 2. Land use on Maryland's Lower Eastern Shore

Major Land Cover Category	Total Area	Percent
Urban or Built-up	95,481	5.12%
Agriculture	471,175	25.25%
Forest	**554,577**	**29.72%**
Water	557,544	29.87%
Wetland	184,489	9.89%
Other	3,025	0.16%
TOTAL	**1,866,291**	**100.00%**

Source: U.S. Geological Survey, 1999

Agriculture and forestry are the most common industries on the Eastern Shore. Farming includes fields crops such as soybeans, small grain, corn and vegetables. The main agricultural enterprise is the raising of poultry as broilers, most of which are processed locally before they are shipped to market. Some raising of livestock is also present but not nearly as common as chickens. Forest products are also a significant source of income. Forested lands are also used for recreational purposes, and hunting leases are a common income generator.

Wet soils dominate the landscape and wetness is a primary factor in determining vegetative cover and management options. Drainage is the most common problem in managing soils, and artificial drainage practices have been common as a means of making soils suitable for agriculture or forestry.

The shores of the Chesapeake Bay, and the fields and forests of the adjoining lands are favorable habitat for a variety of wildlife, including game species such as deer and turkey. It is a key portion of the Eastern flyway for migratory waterfowl. Fish and shellfish in the Chesapeake are a major source of economic activity as well as an attraction for sportsmen and outdoor recreation.

USGS LAND COVER

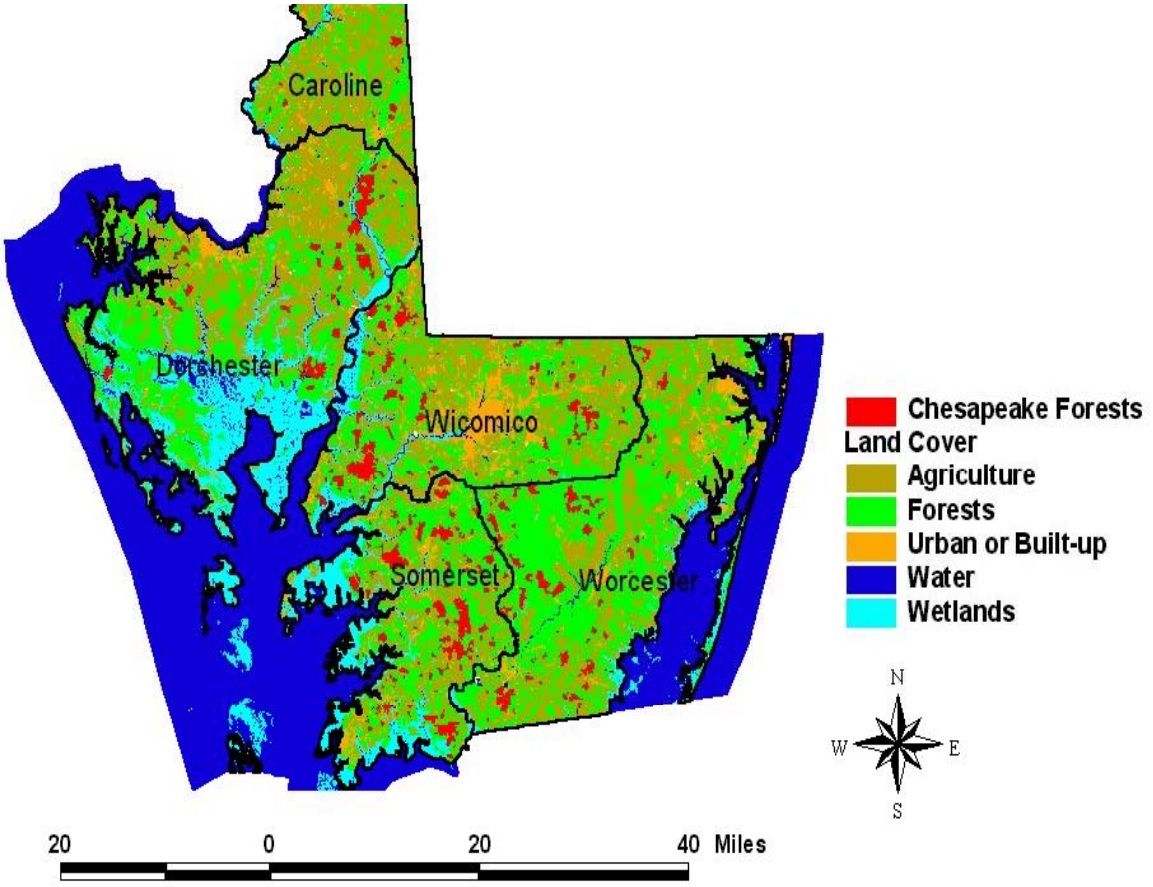

Figure 2. Chesapeake Forest is surrounded by a complex mix of agriculture and forestland uses

Large forest blocks are valued as contributors to the Maryland State Smart Growth objectives, as stated by Maryland's leaders while they were developing the plan to purchase the Chesapeake Forest lands. Taking these lands into state ownership was seen as a way to prevent their further loss to development, and the further fragmentation of what remains of the intact blocks of forest in the region. At the same time, keeping them in sustainable forest use was seen as a way of contributing to the future of the forest-based portion of the region's economy.

2. General Geology and Soils

Much of the region is made up of nearly level lowland flats characterized by windblown materials overlying alluvial and marine sediments consisting chiefly of gravel, sand, silt, clay, and shell fragments. These sediments can extend to depths of several thousand feet. There are three general elevation zones: 1) the flood plains, tidal marshes, and swamps, at elevations near sea level in many places; 2) the Pamlico Terrace, at 0 to 25 feet above sea levels; and 3) the Talbot and Wicomico Terraces, between 25 and 57 feet in elevation. The terraces were formed by meltwaters from the continental ice sheet.

There is not enough topographic relief to cause micro-climatic change, and most of the soils have formed under fairly uniform climatic factors. Because precipitation exceeds evapo-transpiration, the humid, rather uniform climate has caused the soils to be strongly leached. As a result, most of the soluble materials that have been released over time through soil weathering have been removed by leaching. Due to this leaching, the soils are generally low in plant nutrients and strongly acid. The leaching process has also moved clays down into the subsoil on many of the soil types, except for those that were formed in sands or recent alluvium.

Topsoil textures for the mineral soils are commonly sandy loams or loamy sands. Some areas of dunes exist, with deep sands or sand over finer-textured subsoils. In the lowlands and marshes, there are large areas of organic muck soils. In general, the organic muck soils are very poorly drained, and many are too wet for any type of forest or agricultural management. The lowland mineral soils are poorly drained, but are often highly productive forest sites where stands can be established. The sands are droughty, and often of low productivity.

3. Water Resources

The low elevation, flat topography, sandy soils, and shallow groundwater of the outer coastal plain create close contact between human land use activities and aquatic systems, making this region a focal point for water quality issues. Aquatic systems can be grouped into four categories: groundwater, wetlands, streams, and tidal waters.

A. *Groundwater*: The coastal plain of the Delmarva Peninsula is generally characterized by shallow unconfined aquifers, namely the Columbia Group, which extends 3 to 60 meters deep. However, the depth and flow paths of groundwater vary across the landscape. It can be broken down into three categories which better describe the groundwater characteristics:

1 Well-drained upland – The surficial aquifer in these region is unconfined within sediments 24-30 meters thick, and the depth of water ranges from 3-10 meters in topographic highs to surface level in low lying areas. Groundwater flow paths range from about 1 km to several km. The longest, oldest flow paths originate in topographic highs, extend to the base of the aquifer and discharge to 2nd and 3rd order streams through the hyporheic zone (beneath the stream channel). The water contained in them can be 50 years old when it is discharged to the stream system. Shorter, younger flow paths originate in near-stream recharge areas and are the main source of baseflow to first order streams.

2 Poorly drained uplands – The surficial aquifer in this area is found in sand and gravel sediments greater than 30 meters thick. Groundwater tables in this area are generally less than 3 meters deep. This area is characterized by a combination of high water tables and small degree of stream incision that results in groundwater gradients too low to

effectively drain the area. Groundwater flows tend to be shorter in the northern part than the southern part due to the increased aquifer thickness further south. As a result, groundwater flow paths tend to be shorter and shallower in the northern part (100 m to 1 km) and longer and deeper in the southern part (several km). Local flow patterns vary seasonally, however, smaller localized flow paths associated with depressional wetlands and intermittent streams can occur during the wet season. A more regional flow system from topographic highs to perennial streams is active throughout the area during the drier seasons.

3 Surficial Confined – This area is characterized by a confining unit of fine grained material which separates two sand layers. The top sand layer is 1-6 meters thick underlain by the 0-13 meter thick confining layer composed of clay, silts, and peats. The lower sand unit can be 25-30 meters thick. Generally the groundwater is within 3 meters of the surface and occurs in the upper sand unit. Local groundwater flow paths, in the upper unit, are relatively shallow and generally less than 300 m. Regional flow paths in the lower sand unit are up to 10 km long and flow from drainage divides to major streams and rivers. Residence time in the upper sand unit is 15 years or less and in the lower sand unit it is at least 40 to 50 years except where hydrologic connections occur when the confining unit is absent.

Because of its shallow nature, groundwater on the lower Eastern Shore is subject to anthropogenic influences. Certain areas, particularly around highly developed areas, are subject to large groundwater withdrawals that can create cones of depression that may affect environmental conditions. In highly permeable areas, groundwater can also be affected by nutrient or chemical loadings. The USGS has documented a close relationship between land use and permeability of soils to groundwater quality and chemistry and has identified the Delmarva Peninsula as an area at risk of groundwater contamination due to the high nutrient loading on the land. A groundwater monitoring study by the USGS found that 70% of the wells in the surficial aquifer on the Delmarva Peninsula had detectable levels of nitrate with some samples reaching 48 mg/l (EPA drinking water standard is 10 mg/l).

B. *Wetlands*: Relative to the rest of Maryland, wetlands are abundant on the lower Eastern Shore, occupying approximately 10% of the area. Dorchester County alone accounts for 28 percent of the state's wetlands. Wetlands vary greatly in their form and community type, ranging from vast emergent marshes to isolated vernal pools. The predominant types on the lower Eastern Shore can be divided into four categories by their hydrogeomorphic features: tidal, riverine, depressional, and flats.

1 Tidal: Tidal wetlands are subject to regular flooding by tides either on a daily basis or an infrequent basis due to season high tides. In low-lying areas surrounding Tangier Sound and its tributaries, wind events may cause flooding on a periodic basis. Some Chesapeake Forest lands may be subject to seasonal or periodic tidal influence, which may affect timber production. Sea level rise has caused tidal influence to move further inland and will be a factor to consider in the management of low elevation tracts.

2 Riverine wetlands are located on floodplains or adjacent to stream and rivers. If the floodplain is still functional, the riverine wetland will be flooded by high stream-flow events. If the stream has been channelized, the floodplain may not receive regular

flooding from storm events, but will receive water from groundwater moving toward the stream. Many of the riverine wetlands are forested with mixed hardwoods but may have scrub/shrub and emergent components as well.

3 Depressional wetlands do not have defined outlet channels and receive water from seasonal groundwater and/or surface water flows from a small contributing watershed. Because of their relative isolation, depressional wetlands are typically nutrient poor, creating a habitat for numerous rare plant and animal communities. Some of these are locally called Delmarva Bays. The size of depressional wetlands varies from less than an acre to over 10 acres and their vegetative communities range from forested to open water.

4 Wetland flats are large expansive wetlands, which occur on interstream divides. They are generally only temporarily or seasonally flooded by high groundwater levels and are commonly forested wetlands with either deciduous or evergreen stands. These wetlands are the most common type of wetland on the Eastern Shore.

C. *Streams*: There are approximately 750 miles of mapped first through third order streams on the lower Eastern Shore. The Maryland Biological Stream Survey has conducted stratified random samples of streams within each of the major river stream basins (Choptank, Nanticoke/Wicomico, and Pocomoke). Based on those results, Tables 3A, 3B, and 3C indicate the biological and physical conditions estimated to exist in the streams sampled in the region.

For the purposes of this resource assessment, results for the Choptank watershed, which was sampled two years as opposed to one for the other watersheds, were averaged evenly between the two years. Totals of assessment categories do not sum to 100% in some cases because some sampling stations were not rated due to lack of access or sample size. According to the MBSS, the primary stressors, which were associated with decreased biological conditions were agricultural land, physical habitat quality, acid deposition, and riparian buffer width.

Table 3A. Estimated Percentage of stream miles by category, Fish Index of Biotic Integrity.

River Basin	Good	Fair	Poor	Very Poor
Choptank	24.1	43.5	11.6	5.2
Nanticoke/Wicomico	3.9	69.6	18.1	0
Pocomoke	12.5	48.1	9.7	0
Statewide	19.5	25.7	14.5	14.0

Table 3B. Estimated percentage of stream miles by category, Benthic Index of Biotic Integrity.

River Basin	Good	Fair	Poor	Very Poor
Choptank	5.3	17.9	30.6	46.2
Nanticoke/Wicomico	12.3	27.7	26.4	33.5
Pocomoke	0.3	11.5	18.5	69.2
Statewide	10.8	37.7	25.7	25.3

Table 3C. Estimated percentage of stream miles, by category, Physical Habitat

River Basin	Good	Fair	Poor	Very Poor
Choptank	45.4	13.2	20.8	20.7
Nanticoke/Wicomico	6.5	16.8	26.4	50.3
Pocomoke	1.8	43.3	35.5	19.4
Statewide	19.9	28.5	29.1	22.4

D. *Tidal Waters*: The vast majority of the lower Eastern Shore of Maryland flows to the Chesapeake Bay through four major tributaries (Choptank, Nanticoke, Wicomico, and Pocomoke Rivers) with the western portion of the region flowing toward Chincoteague Bay. Within the Chesapeake watershed, all but the Choptank flow first through Tangier and Pocomoke Sounds which traditionally have been two of the most critical fish and shellfish habitats in the Bay.

Hydrologic modifications

As settlement and use of the land on Maryland's lower Eastern Shore expanded, wetlands were ditched and drained. Maryland has lost approximately 70% of its historic wetland area with a large portion of the wetland conversions occurring on the lower Eastern Shore (Table 3). Historically and still today, wetlands are drained primarily to support agriculture and development. To provide early growing season access to fields and to prevent flooding of houses built on former wetlands, major drainage ditches are maintained by public ditch associations which are legislatively established and have taxing authority.

Table 4. Percent of historic wetlands (hydric soils) that are mapped as unmodified wetlands by the National Wetland Inventory

Watershed	% of Unmodified Historic Wetlands
Lower Wicomico	19.4
Lower Pocomoke	23.7
Upper Pocomoke	17.2
Marshyhope	21.4
Wicomico River Head	3.3
Wicomico Creek	25.4
Manokin River	42.5
Nanticoke River	44.7
Transquaking River	73.9
Big Annemessex	31.8
Pocomoke Sound	31.5
Nassawango Creek	24.6
Dividing Creek	31.9
Fishing Bay	87.8
Monie Bay	49.8

While ditching of wetlands has allowed farming and development to occur in areas otherwise inaccessible, drainage has had a significant impact on the wetlands and water quality of the lower Eastern Shore. In addition to the direct loss of wetland habitat, drainage also alters the biological, physical and chemical processes that allow wetlands to filter nutrient and sediment pollution from surface and groundwater flows. By increasing the rate at which water is moved off the land, drainage ditches bypass much of the nutrient cycling that occurs in wetlands and streams and delivers greater amounts of nutrients and sediment to downstream reaches, including Tangier Sound and the Chesapeake Bay. During the hastened runoff and drainage, opportunities for sedimentation to remove suspended solids are reduced. Drainage of wetland soils makes them more aerobic, thereby decreasing rates of denitrification, which is the primary mechanism for nitrogen removal in wetland soils.

As with wetlands, streams have been subject to a high degree of hydrologic manipulation on the lower Eastern Shore (Table 5). Historically, streams were commonly channelized by dredging and straightening to facilitate drainage and provide flood control. These actions cause the same impacts described in the wetlands section above, but also degrade stream habitat as well. Channelization disconnects a stream from its floodplain and can cause greater scouring, greater bank instability, and disruption of the natural riffle/pool habitat pattern.

Table 5. Estimated percentage of stream miles with evidence of channelization

River Basin	Percent of Stream miles
Choptank	36
Nanticoke/Wicomico	52
Pocomoke	81
Statewide	17

Water Quality Indicators

Water quality in the tidal tributaries and Tangier and Pocomoke Sounds is generally poor due high nutrient and suspended solid concentrations. With a few exceptions, water quality monitoring by the Maryland DNR has documented fair or poor conditions for total nitrogen, total phosphorus, total suspended solids, algae abundance and water clarity (secchi depth) (Source: www.dnr.maryland.gov). Conditions have significantly worsened from 1985 to 1998 in Tangier Sound for total suspended solids, algae abundance, and water clarity.

As a result of the declines in water quality in Tangier Sound, the area of underwater grasses, which are considered the best single indicator or water quality in the Bay, declined by 62% between 1992 to 1998. Accordingly, the lower Eastern Shore has been identified as a priority area in Maryland's Clean Water Action Plan and under the US EPA Chesapeake Bay program. All of the tidal tributaries to the Chesapeake Bay have been listed on the EPA 303(d) list as impaired water bodies for nutrient pollution, and some reaches have been listed also for other water quality issues as well.

4. Wildlife Resources

Chesapeake Forest wildlife habitats occur within a landscape that has been heavily fragmented by agricultural and residential development. The Chesapeake Forest lands, themselves, have been heavily fragmented through decades of intensive timber management, road building and conversion of native hardwoods to pine plantations. Management opportunities for wildlife on Chesapeake Forest include provision of habitat conditions that are critical to rare or declining species. Some critical habitat conditions will require adjustment of spatial and temporal provision of early successional pine habitats. Other critical habitat conditions will require incorporation of additional vegetative diversity by allowing hardwoods to re-infiltrate or dominate on some sites. Finally, some critical habitat conditions will require adjustment of rotation length to provide for forests that are allowed to grow beyond economic maturity.

Some species of wildlife present on Chesapeake Forest are forest obligates. Viability of forest obligate populations depends solely on the characteristics of these forestlands. Populations of other species of wildlife found on Chesapeake Forest are more affected by the characteristics of adjacent wetland or agricultural habitats. Chesapeake lands in those cases will contribute to, but not insure, species viability.

Endangered and Threatened Species of Special Concern

Species of special concern were identified by staff of the Wildlife and Heritage Service of the Maryland Department of Natural Resources and/or identified through reference to the Rare, Threatened, and Endangered Animals of Maryland a publication by Maryland DNR, 12/03. However, this list represents DNR's current knowledge, and is constantly changing as new information is collected.

Delmarva Fox Squirrel: The U. S. Fish and Wildlife Service has published a Recovery Plan for the Delmarva Fox Squirrel (DFS) (USFWS 1993) and sources of data for this section include the Recovery Plan and personal communication with personnel from the USFWS and the Maryland DNR. The DFS was one of the first species listed under the Federal ESA. The Recovery Plan has been revised once, and is currently under review for a second revision. Population levels of DFS are believed to stable or slightly increasing. The original range of DFS included southeastern Pennsylvania, southern New Jersey, and Delaware, Virginia and Maryland portions of the Delmarva Peninsula. Remnant populations of DFS persist naturally in portions of Kent, Queen Anne's, Talbot, and Dorchester Counties, Maryland and Sussex County, Delaware.

DFS have been translocated into southeastern PA (1 site), Delaware (2 sites), Virginia (2 sites), and Maryland's Eastern Shore (13 sites). Not all translocations have established viable populations. Figure 14 in Chapter 8, shows DFS sites on or in near proximity to Chesapeake Forest Lands.

DFS are opportunistic, but generally occupy mature pine and hardwood forests, both bottomland and upland, with a relatively open understory. Forest areas that contain a variety of nut and suitable seed bearing trees, over-age hardwood trees with hollows for den sites, and nearby supplemental food sources are preferred. DFS feed on mast (oak, hickory, beech, walnut and loblolly pine) in the fall. Summer and spring foods include green loblolly pine cones, tree buds and flowers, fungi, insects, fruit and seeds. Like most squirrel species, body

condition of DFS individuals depends primarily on fall mast supplies. Caching of fall mast provides nutrition during winter shortages. Spring food resource availability may be a limiting factor on DFS abundance.

DFS prefer dens in tree hollows which afford greatest protection from weather and predation. DFS will also construct and use leaf nests as small day shelters, feeding platforms, or winter and rearing nests.

Quality habitat can on the average be expected to support 1 DFS per 10 acres, though an individual squirrel's range is approximately 40 acres. Food abundance, disease, and predation affect DFS numbers from year to year. The exact causes for the DFS decline are unknown, although forest clearing and changing patterns of land use are suspected to have contributed to endangerment.

DFS can be reclassified to threatened when population viability is better understood, benchmark populations are shown to be stable or expanding for at least five years, and ten translocated colonies are shown to be stable or expanding. Delisting will be considered when an additional five colonies are established, monitoring establishes that translocated populations are stable or thriving, perpetual protection of suitable habitat areas in all counties in which the species occurs is achieved, and mechanisms are in place to facilitate establishment of new populations, species range expansion, and population interchange.

Bald Eagle – According to the USFWS, the Chesapeake Bay ecosystem may have once hosted 3,000 nesting pairs of bald eagles (Haliaeetus leucocephalus). In the late 1800's, people began to clear parcels of land for farm and agricultural use thereby impacting eagle nesting areas. With the development of chemical pesticides in the late 1950's, DDT caused reproductive failure in eagles with disastrous consequences. The bald eagle was placed on the Endangered Species List in 1967.With the banning of these pesticides and an aggressive monitoring, reintroduction and recovery effort the eagle has made an impressive comeback here, and nation-wide. In 1995, the eagle was upgraded from endangered to threatened status.

The Chesapeake Bay watershed provides the open marsh, undisturbed shoreline habitat that eagles need for nesting, roosting and feeding. Chesapeake Forest Lands have several Bald Eagle nesting sites, which are monitored annually by the Department.

Other Federally Listed Species that Occur In Maryland

Besides Bald Eagle and DFS, animal species listed by the USFWS as threatened or endangered that occur in Maryland, but are not believed to occur on Chesapeake Forest properties include:

- E -- Bat, Indiana (Myotis sodalis)
- T -- Beetle, northeastern beach tiger (Cicindela dorsalis dorsalis) T -- Beetle, Puritan tiger (Cicindela puritana) E -- Darter, Maryland (Etheostoma sellare) T -- Plover, piping (Charadrius melodus) T -- Turtle, bog (Muhlenberg) (Clemmys muhlenbergii) E -- Wedgemussel, dwarf (Alasmidonta heterodon)

State Listed Species of Concern that Occur on Maryland's Lower Eastern Shore

According to Maryland DNR (personal communication, 12/7/99), a summary of current and historical rare, threatened and endangered animal species potentially found on or within ¼ mile of CFP lands would include:

Species	Counties of Occurrence
Eastern Tiger Salamander	Caroline, Dorchester, Somerset
Henslow's Sparrow	Caroline, Dorchester
Barking Tree Frog	Caroline
Carpenter Frog	All CFP counties except Somerset
Sedge Wren	Dorchester
Eastern Narrow-Mouthed Toad	Dorchester, Somerset, Worcester
Rare Skipper	Dorchester
Swainson's Warbler	Wicomico, Worcester
Palamedes Swallowtail	Somerset, Worcester
Northern Pine Snake	Worcester
Red-cockaded Woodpecker	Dorchester, Worcester

Eastern Tiger Salamander – According to The Nature Conservancy (TNC), Eastern tiger salamanders spend most of their lives underground in self-made burrows, mole tunnels or under logs and come to the surface only to mate and lay eggs, which has made them difficult for researchers to study. They typically congregate in vernal and fishless ponds or rain-filled gravel pits in late fall and then breed through early spring. Destruction of critical habitat, use of pesticides and pollution are among the chief reasons for their endangered status.

Henslow's Sparrow – Breeding habitat of Henslow's Sparrow includes neglected weedy fields (especially broomsedge), wet marshes, and salt marsh edges. Dense herbaceous vegetation, moderate amounts of moisture, ground litter, and singing perches are all special habitat requirements (DeGraaf and Rudis 1986).

Barking Tree Frog – According to TNC, the barking tree frog spends most of its time in trees feeding on insects. During cold or dry weather, it will burrow into the ground for refuge. In spring, the barking treefrog breeds in temporarily flooded ponds beneath open forest canopies. Range of the frog includes the coastal plain from Louisiana to New Jersey.

Carpenter Frog – According to the Georgia Museum of Natural History, the Carpenter Frog breeds from March to August in permanent water. This frog is nocturnal and very secretive. It eats small insects and other small invertebrates. There has been some work that suggests that water snakes of the Genus Nerodia prey heavily on this species. The Carpenter Frog prefers slow moving or standing water with a great deal of aquatic vegetation. Throughout it range, it is associated with acidic waters of bogs, swamps and blackwater rivers. Its color blends well with these waters.

Sedge Wren – As its name suggests, the Sedge Wren prefers sedge meadows, shallow sedge marshes with scattered shrubs and little or no standing water, coastal brackish marshes (DeGraaf and Rudis 1986).

Eastern Narrow-Mouthed Toad – According to the Savannah River Ecology Lab, narrow-mouthed toads can be found by flipping over debris in woodland areas near water, or in the wetlands at night during breeding season (summer mostly). Narrow-mouthed toads eat ants.

Rare Skipper – According to the U. S. Geological Survey (USGS), rare skipper adults feed on nectar from flowers of pickerel weed and swamp milkweed. Habitat includes brackish river marshes and abandoned rice paddies. The range of rare skippers includes isolated populations along the Atlantic Coast from southern New Jersey and Maryland south to coastal Georgia.

Swainson's Warbler – According to TNC, mature, rich, damp, deciduous floodplain and swamp forests with deep shade from both canopy and understory cover are preferred habitats of Swainson's Warbler. On the coastal plain, the species occurs in the shadiest parts of the forest, with dense upper canopy, lower canopy and shrubs, and little herbaceous cover. The shrub stratum is often nearly monospecific stands of giant cane in floodplain forest; sweet pepperbush or fetterbush in swamps at the northern end of range such as the Great Dismal Swamp in Virginia and Pocomoke Swamp in Maryland and Virginia and headwater swamps of the Atlantic Coastal Plain; or scrub palmetto in bottomlands.

Although often reported to inhabit canebrakes in the literature, it is clearly not exclusively a cane species; structure of the habitat - both overstory and dense shrub understory canopies characteristic of successional forests - is apparently of primary importance, and a variety of shrubs will do. Since the habitat is successional, rather than climax, management must be aimed at regenerating suitable dense-shrub understory conditions on a temporal and spatial rotation adequate to maintain the warbler in the general area. It has been observed to reoccupy clearcut stands after a few years in South Carolina coastal plain bottomland hardwood habitat, but this has not been formally studied in the region. Published management recommendations suggest selective cutting of mature trees in warbler territories could be practiced if at least 70% canopy closure were maintained, clearcuts were no larger than 4 ha to minimize habitat disturbance, and contiguous woods should not be cut for 10 to 15 years to allow canopy regeneration in the cut-over area.

Palamedes Swallowtail – USGS reports that Palamedes Swallowtail caterpillar feed on plants of the Laurel family especially redbay . Adult swallowtails feed on nectar from flowers of sweet pepperbush, thistles, blue flag, and azalea. Habitat includes wet woods near rivers and broadleaf evergreen swamp forests. Range of the Palamedes Swallowtail spans the Atlantic coast from southern New Jersey (rare) to Florida; west and south along Gulf Coast to central Mexico.

Northern Pine Snake – According to the New Jersey Division of Fish and Wildlife, Northern Pine Snake are found in dry pine-oak forest types growing on very infertile sandy soils. Within these generalized habitats, pine snakes select open sandy clearings with little ground cover for nesting. Summer den sites are also typically located in clearings near fallen logs. Winter hibernacula are located in nearby areas providing more vegetation cover and leaf litter. The greater spatial frequency and temporal persistence of clearings within sandy, infertile soils may partially account for association of pine snakes with these soils. Soil texture may also be important because pine snakes are among the only snakes known to excavate their own hibernacula and summer dens.

Red-cockaded Woodpecker – Red-cockaded Woodpecker are extirpated from Maryland, but are present in Southeastern U. S. pine timberlands similar to those found or potentially found

within Chesapeake Forests. The Department has no immediate plans to reintroduce the species. CFL lands will be of critical importance to any reintroduction effort in the future. Critical habitat for Red-cockaded Woodpecker is pine savannah.

Plants of Special Concern

Swamp Pink – According to the USFWS, the Swamp Pink usually is one of the first wildflowers to bloom in the spring. The plant usually blooms from March to May. Its fragrant flowers are pink and occur in a cluster of 30 to 50. Its dark evergreen, lance-shaped, and parallel-veined leaves form a basal rosette which arises from a stout, hollow stem. New Jersey supports the largest and most numerous populations of the species with 68 existing sites spread over 12 southern counties in the Coastal Plain area. Most of the populations are located along the Pinelands fringe in the Delaware River Drainage. Besides New Jersey, six other States support populations including Delaware; Maryland; Virginia; North Carolina; South Carolina, and Georgia. In Maryland's Coastal Plain, six plant populations are located on privately-owned lands in Anne Arundel, Cecil, and Dorchester Counties. One other population has been extirpated. Swamp Pink occurs in a variety of wetland habitats. These include Atlantic white-cedar swamps; Blue Ridge swamps; swampy forested wetlands which border small streams; meadows, and spring seepage areas. The plant requires habitat which is saturated, but not flooded, with water. Swamp Pink is commonly associated with evergreen trees such as Atlantic white-cedar; pitch pine; American larch; and black spruce. The species appears to be somewhat shade tolerant and to need enough canopy to minimize competition with other more aggressive species. In areas with less canopy, deer are more likely to eat the plant's flowers, leaves, or shoots. The loss of wetlands to urban and agricultural development and timbering operations originally was the primary threat to the species. Now, State wetland and Federal endangered species protection laws have slowed the loss of wetlands, and the major threat to the Swamp Pink is habitat degradation caused by off-site disturbances. Some of these impacts include off-site water withdrawal for irrigation or crop production; discharge from sewage treatment plants; increased siltation from the inadequate control of soil erosion; and the introduction of excess nutrients or chemicals into the water. To alleviate the impacts of off-site disturbances, buffer zones may be established around protected habitat.

Sensitive Joint Vetch – Sensitive joint-vetch is native in freshwater to slightly brackish tidal marshes of the Mid-Atlantic states. It prefers the lower edge of the inter-tidal marsh zone, receiving daily inundations. The soil may be mucky, sandy or gravelly. Historically, sensitive joint-vetch was known from New Jersey, Delaware, Pennsylvania, Maryland, Virginia, and North Carolina. It is no longer found in Delaware or Pennsylvania. The Department reports sensitive joint vetch is found in Somerset and Wicomico Counties.

Plant communities of Special Concern

Xeric Sand Dunes: very well drained sand ridges deposited by historical flood tides. Sand Ridges support a variety of rare and threatened insect and plant species.

Delmarva Bays and associated life zones: isolated depressional wetlands that serve the needs of wetland breeding animals and support several species of rare plants

Riparian Swamps (Bald Cypress, Atlantic White Cedar)

Vernal Pools and Seasonal Wetlands: temporary wetlands present in late winter and spring that support amphibian reproduction

Game Species of Special Concern

A small fraction (3-4%) of Maryland residents hunt. Maryland first began licensing hunters in 1916. Hunting license sales peaked at 180,000 in the early 1970's. Sales have declined to about 135,000 now. The current number of youth hunters has shown a 70% decline from peak numbers in the early 1970's. Maryland hunters are mostly males between the ages of 30-49 years of age. Most hunters live in urban settings. Residents of Baltimore County bought 11.9% of licenses sold statewide. Residents from the five lower shore counties accounted for 9.7% of hunting licenses sold statewide.

Approximately half of the Chesapeake Forest acreage is leased to hunt clubs. Club membership varies from a couple of people to greater than 30 people. Club leases are primarily for deer hunting. Other lease opportunities, depending upon the site, include waterfowl and quail hunting.

Wild Turkey – Wild turkey populations were established in the 5 County CFL area within the last few decades. Using spring harvest as a guide, populations were first established in Worcester, followed shortly thereafter by populations in Dorchester and Somerset, then by Caroline and Wicomico. Spring harvest figures track population increase in the 5-county region (Figure 3). In the years since 1990 when there was a harvest of 12 birds, harvest numbers have increased , except for 2004 where there was a slight decline. Brood habitat is reported by the Department to be the main environmental factor affecting populations.

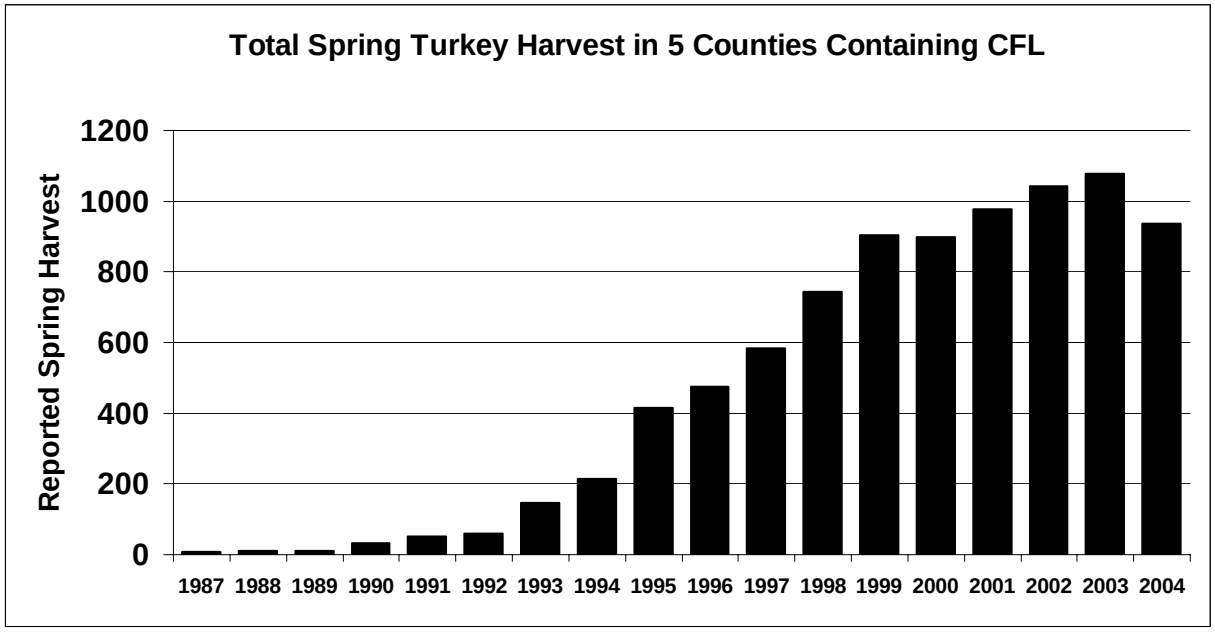

Figure 3. Spring turkey harvest trends, Eastern Shore.

Northern Bobwhite Quail – Bobwhite populations have shrunk throughout Maryland, and eastern shore counties now represent the bulk of bobwhite quail range in the state. Quail harvest numbers have decreased since 1966 (Figure 4). The Partners in Flight Mid Atlantic Coastal Plain Bird Conservation Plan lists the Northern Bobwhite as a species with high physiographic priority indicating moderately high global vulnerability and a relatively high abundance but declining population trend within the physiographic area. The Department has ranked Northern Bobwhite as a priority concern species for CFL lands.

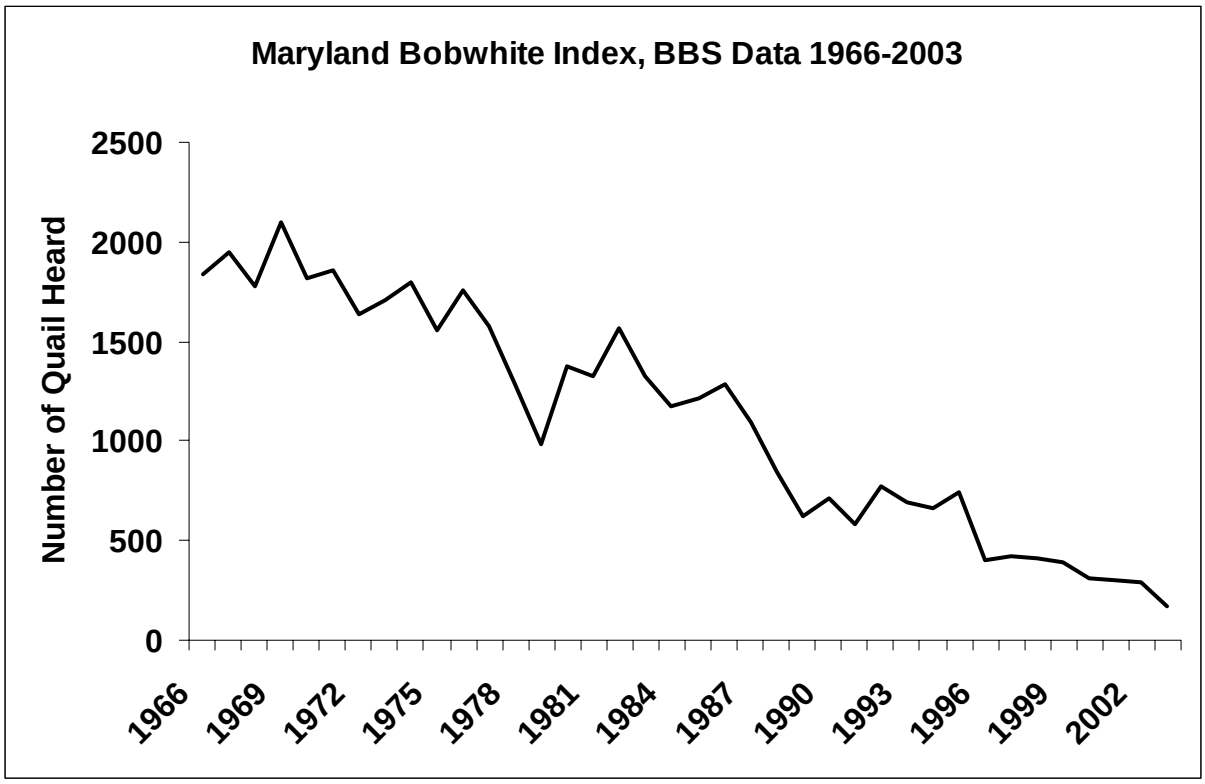

Figure 4. Harvest trends on Bobwhite Quail have declined significantly.

Furbearers – Resident furbearer populations are stable or growing within the 5-county region. Beaver, otter and possibly bobcat are at their highest levels witnessed in the last century. Nutria, an invasive exotic rodent introduced into Dorchester County in 1943, and now present throughout the 5-county region, continue to increase with populations now estimated as high as 50,000. Nutria damage or destroy root mats of marsh plants, leading to severe degradation of marsh structure and function.

White-tailed Deer – Harvest trends seem to indicate that white tailed deer thrive in the 5-county region (Figure 5). Over-abundant deer populations can threaten the existence of some sensitive plant species and can change forest structure and composition. Department personnel have expressed concern over their ability to control white-tailed deer populations, especially in areas closed to deer hunting.

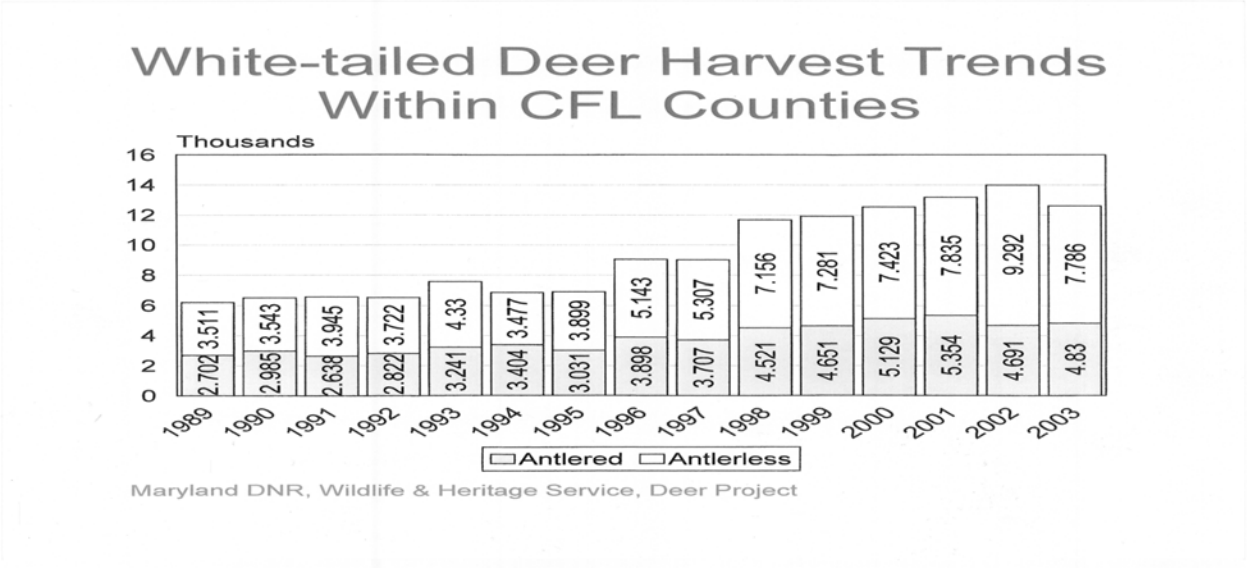

Figure 5. White-tailed deer are a popular game species, but can overwhelm their habitat unless populations are kept in check.

Sika Deer – Sika deer, a native deer of Asia introduced to Maryland in the early 1900's, inhabit marshes, swamps and associated Chesapeake Forest woodlands in Dorchester County (populations are also present on Assateague Island in Worcester County). The population appears to be stable and is controlled through hunting (Figure 6).

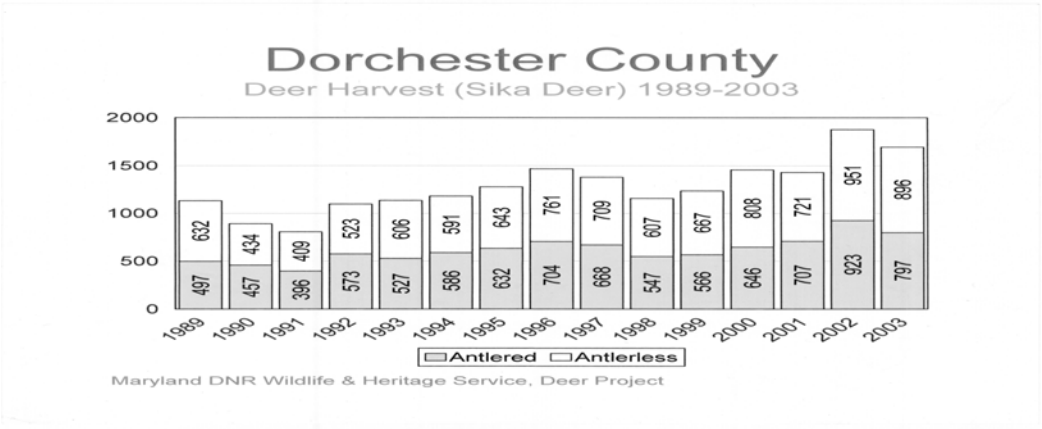

Figure 6. Sika deer populations are also controlled by hunting.

Migratory Birds of Special Concern

Waterfowl Associated with Wetlands – Important waterfowl areas occur throughout the Eastern Shore. Bottomland hardwood floodplains, beaver impoundments, Delmarva Bays, and freshwater/brackish emergent wetlands serve as wood duck, mallard, teal and black duck habitat. Black Duck are recognized by Partners in Flight Mid Atlantic Coastal Plain Bird Conservation Plan as a species of special concern.

Woodcock – Spring "singing ground" surveys performed by the U.S. Fish and Wildlife Service suggest that eastern woodcock numbers have been declining by an average of 2.6 percent per year since these surveys were started in 1968 (Figure 7). Most woodcock biologists suspect that alterations of habitat, losses to development and changes due to maturation of abandoned farmland are the cause of the population decline. Woodcock use Chesapeake Forest as breeding and wintering habitat. Woodcock prefer moist soil areas with dense seedling/ sapling cover and rich humus layers because earthworms, their primary food, are most plentiful in these habitats. Chesapeake Forest lands are important to woodcock as breeding, nesting, migratory, and possibly wintering habitat.

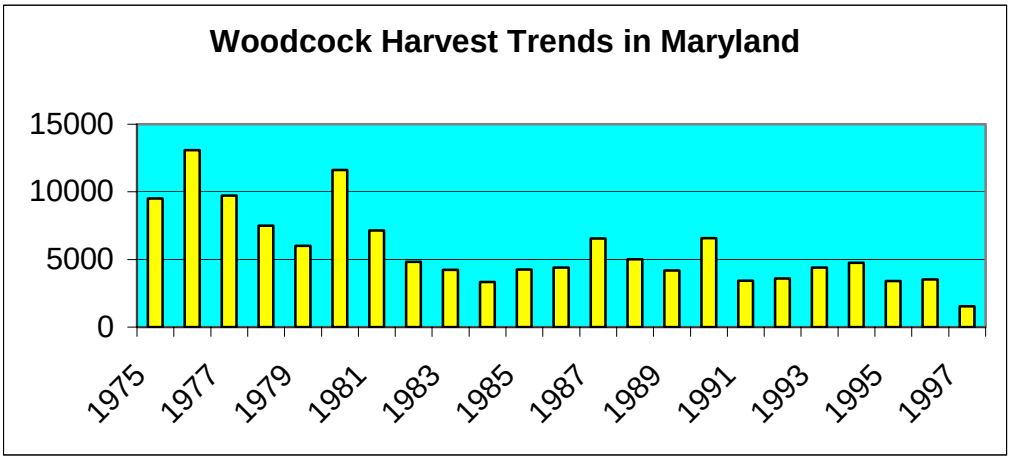

Figure 7. A long-term decline in woodcock harvest is basis for concern over the future of this species.

Neo-tropical migrants – Many neo-tropical migrants breed, nest or migrate through the region. One of the largest conservation concerns in the region with migratory birds is the fragmentation of forest blocks. Other conservation concerns within the region include the loss of wetlands, loss of habitat due to development, and loss of habitat due to intensive agriculture. Rather than list each bird species individually, examples of critical habitats that serve broad migrant bird guilds are listed. The Partners in Flight Mid-Atlantic Coastal Plain Bird Conservation Plan recognizes five critical habitat types that are present throughout the Eastern Shores, as well as on the Chesapeake Forest. Those habitat types and the birds that use them are listed below.

1. Pine Savannah – A pine savannah is a habitat with large scattered mature pine trees and very open understory. Pine savannahs are frequently created by prescribed burning within mature pine stands. Along with Red-cockaded

Woodpecker, seven species identified as high priority within the Partners in Flight Mid Atlantic Coastal Plain Plan include Prairie Warbler, Bachman's Sparrow, Brown-headed Nuthatch, Eastern Wood Peewee, Red-headed Woodpecker, American Kestrel, and Chuck-will's-widow. Historically, the absence of fire and the intensity of management on CFP lands suggests very few acres of pine savannah are currently available.

2. Forested Wetlands – From cypress swamps to seasonally wet floodplains, forested wetlands provide critical habitat for a host of high priority species. Highest concern is centered on Swainson's Warblers, Cerulean Warbler, Kentucky Warbler, Acadian Flycatcher, Yellow-throated Vireo, and Prothonotary Warbler.
3. Freshwater/Brackish Wetlands – Besides Black Duck, freshwater/brackish wetlands on Chesapeake Forest Lands also provide critical habitat for King Rail, American Bittern, Least Bittern, Pied-billed Grebe, and Common Moorhen.
4. Upland Mixed Forests – Mixtures of mature pine and hardwood within forest tracts provides critical habitat for Cerulean Warbler, Wood Thrush, Kentucky Warbler, Acadian flycatch, Worm-eating Warbler, Eastern Wood-pewee, and Louisiana Waterthrush. Most of these species also have an area requirement to maximize productivity. Maximum Cerulean Warbler density for example, occurs in forest of at least 1,000 acres. Chesapeake Forest has 8,513 acres variously typed as mixed hardwood/pine.
5. Early Successional Shrublands – Recent clearcuts and young pine plantations provide critical habitat conditions for Prairie Warblers, Bachman's Sparrows, Field Sparrows, Yellow Breasted Chats, Brown Thrashers, Eastern Towhees, and White-eyed Vireos. Chesapeake Forest has 25,682 acres currently typed as open (0-5 years) or sapling stage (6-15 years).
6. Pine Plantations – Older pine plantations, if managed with thinnings to maintain relatively open canopies, will provide critical habitat for species that adapt to grass/shrub understories beneath open pine canopies. These high priority species include (see also Early Successional species listed above) Blue-winged Warbler, Brown-headed Nuthatch, Northern Bobwhite, Carolina Chickadee and Gray Catbird.

5. The forests of the Eastern Shore

Historic land cover shows the region dominated by hardwood forests mixed with pine softwoods. The oak species present included white oak, willow oak, pin oak and cherry bark oak (Smith, 1998). Other hardwood trees found historically on the Eastern Shore include sweetgum, silver and red maple, black gum, dogwood, birch, beech, bay, and holly. "In very wet areas some black pine and pond pine grow; cypress was plentiful in the swamps. Loblolly pine and Virginia pine probably were also present, but these trees were not found in pure stands until after many areas had been cleared of hardwoods. The northern range of natural loblolly pine runs roughly through the middle of the Eastern Shore, with hardwoods increasingly dominating stands as one moves northward through the region. Loblolly pine became dominant in heavily cut areas and on abandoned cropland. Virginia Pine became dominate in areas of sandier and droughtier soils."(Somerset, 1966)

Practically no virgin forests remain on the Eastern Shore, and most forests have been cut over several times. Many areas (including many that are once again in forest) have been cleared for conversion to agriculture in the past. As Table 6 illustrates, the majority of the forests on the Eastern Shore are owned by non-industrial private owners. With about 70 thousand acres moving from the "industry" column to the "public" column as a result of the Chesapeake Forests transaction, the industry share will decline significantly in the near future. If the Chesapeake Forests remain in sustainable forest production, the impact will be minor. If they were removed completely from production, it would be a significant local impact.

Table 6. Area of timberland by forest type and ownership group

	Eastern Shore			
Forest Type	**All Owners**	**Public**	***Industry***	***NIPF****
		(Thousands of Acres)		
Loblolly_shortleaf pine	224.2	5.9	80.1	138.2
Softwood total	224.2	5.9	80.1	138.2
Percent of Total Softwoods	100.0%	2.6%	35.7%	61.6%
Oak_pine	176.2	6.5	34.3	135.5
Oak_hickory	279.1	11.7	24.3	243.1
Oak_gum_cypress	117.2	12.3	13.4	91.5
Elm_ash_cottonwood	16.5	0	3.2	13.3
Maple_beech_birch	7.3	0	0	7.3
Hardwood total	596.4	30.5	75.2	490.6
Percent of Total Hardwoods	100.0%	5.1%	12.6%	82.3%
All forest types	820.6	36.4	155.4	628.8
Percent of Total All Types	100.0%	4.4%	18.9%	76.6%

Source: MD/DNR Forest Service, 1996 data. * Non-industrial private forest owners

Forest management on the Eastern Shore

Most of the forests on the Lower Eastern Shore are privately-owned, and most are managed for multiple objectives, but chiefly for revenue from the sale of timber and for wildlife habitat to support wildlife-related recreation. The forests on the Lower Eastern Shore are well-suited to meet these objectives because of their ability to provide valuable products and diverse habitats.

As described above, the forests on the Lower Eastern Shore tend to be dominated by either loblolly pine or a mix of southern hardwood species, including many oaks. Most of the forests are even-aged, having regenerated from the abandonment of agricultural land in the middle of the century, or from previous clearcut timber harvests. Some areas have probably seen timber harvests for several centuries, as both Native Americans and early European settlers cleared land and harvested wood for a variety of uses, such as building boats and houses.

Of the many commercial products that a forest on the Lower Eastern Shore can generate, the most valuable is loblolly pine sawtimber. There is a strong market for this because of the many local sawmills engaged in the production of dimensional lumber and structural timbers. Stumpage rates average between $200-300/MBF depending on the quality of wood, tract accessibility, and local market fluctuations. Most mature pine stands are well-stocked and average 8-12 MBF/acre. Thus, a clearcut harvest could generate $1600 – 3600 per acre in stumpage revenue.

There is also a limited market for pine pulpwood and, to a lesser extent, hardwood pulpwood. These markets are weak, and the prices are low compared to other parts of the southeast. Despite the abundance of the hardwood forest, there are very limited markets for hardwood sawtimber, whether it occurs mixed with loblolly or in pure stands. The local mills will typically pay $50-100/MBF for the average hardwood sawlog (a small fraction of the loblolly pine stumpage price). This is because the wet soil conditions, limited merchantable species, and history of high-grading have resulted in a very poor quality of hardwood logs on the Lower Eastern Shore. While it is possible to grow high-quality oak and tulip poplar sawlogs, the hardwood forests are more often characterized by less valuable species, such as red maple, sweet gum, and black gum, that are often poorly-formed and/or marked with mineral stains or decay. On the upper Shore, the log quality is much better and the markets are much stronger.

As a consequence of these markets and growing conditions, most Lower Eastern Shore landowners that desire a commercial return from their forestland focus on loblolly pine. Loblolly pine is managed commercially throughout the Southeast and is one of the most important timber and paper-producing species in the country. It is a fast growing, early successional species that is shade-intolerant. It grows in a wide range of soil and moisture conditions. It will not be successful without direct sunlight. Dense even-aged stands can become established either through planting or by natural regeneration on cutover sites or old farm fields. In the first few decades, individual loblolly pines will aggressively compete for sunlight and nutrients with other pines and with other species. Through a natural process of self-thinning, the slow-growing trees will die from lack of sunlight, and the overall stocking will gradually decrease as the stand develops. Under most situations, loblolly has reached its maximum growth rates by the time it is 40 years old, after which point it grows slowly. Some mature trees will begin dying of natural senescence starting at about 60 years old and it is very rare to find a loblolly tree greater than 80 years old.

Management of loblolly pine on the Lower Eastern Shore varies considerably from practices elsewhere in the Southeast. For the most part, Lower Eastern Shore landowners choose to manage extensively, rather than intensively. Many stands are managed for natural regeneration and long rotations, typically 40-60 years old. Perhaps because of a lack of knowing the management benefits of commercial thinning, most landowners do not incorporate a mid-rotation thinning as part of their management regimes. Additionally, most regeneration is done with minor site preparation, typically only a chemical release treatment. Intensive management practices that are common elsewhere in the Southeast or on Chesapeake land under past ownership, such as mid-rotation fertilization and competition control, pre-commercial thinning to control sapling stocking, and bedding for site-preparation, are not common on NIPF land on the Lower Eastern Shore, although they are occasionally pursued.

In Maryland from 1976 to 1989 the number of private forest owners grew from 95,800 to 131,000, increasing by about 2.7% per year. That calculates out to about 2,600 more owners each year. In 1976, 55% of the owners held less than 10 acres of forest; by 1989 that proportion had grown to 65%. What can be inferred from these trends is that over 2/3 of the forestland owners in the area are now essentially large-lot homeowners who will seldom be able (or desire) to manage their forest for timber production. Some properties will be managed for wildlife and recreation value, but small, fragmented pieces are limited in their capacity to produce those values, as well.

Convincing private landowners to manage forests on a long-term, sustainable plan is affected by the rapid turnover of forest properties. In this area, each tract is sold on average once every 12 years and the size often decreases at the time of sale. This produces a constantly changing clientele for forestry education, and a constantly shifting set of land management objectives that can disrupt or destroy long-term planning.

To assist the landowner with the management of their forest, there are a variety of forestry services and sources of information available. The Maryland Department of Natural Resources, Forest Service, maintains at least one forester in each county. Many landowners rely on them for impartial advice concerning timber sales, the development of forest stewardship plans and the carrying out of forest management activities such as reforestation after a timber sale. In addition, there are several private consulting foresters who assist landowners with all aspects of forest management. Most of the actual management activities, such as road building, site preparation, tree planting, and harvesting, are contracted out to separate businesses. The Lower Eastern Shore has access to many of these types of contractors but not in the quantity that characterize other, less isolated, areas of commercial forestry. Consequently some specific management practices have not been feasible because there has not been sufficient demand to support an operator.

In general, the Lower Eastern Shore landowners do not seem driven to achieve maximum economic returns, with many owners who are as likely to be interested in providing good habitat for game species as in generating revenue.

The forest products industry

About 205 million board feet of pine sawtimber, hardwood sawtimber, and pine pulpwood is consumed annually in the Lower Delmarva Peninsula. The big users are five pine sawmills, and two pine pulpwood chipping operations for paper making. There are also three hardwood sawmills and a variety of other users that are influenced by the availability of timber. The pine sawmills produce a variety of wood products, most of which are designed to be treated with a preservative and used outside or in contact with the ground. Some examples of these products include: piling; utility poles; building poles; bulk heading; dimension lumber and decking. The hardwood mills also manufacture an array of products, e.g., timbers, construction lumber, railroad ties, pallet stock, and some high quality lumber. There is a sharp contrast in the quality of the hardwood from the northern and southern portions of the Peninsula. Hardwood grown on the Lower Peninsula is of poorer quality due to the soils, which can stain the wood. These soils also favor higher percentages of less desirable hardwood species, such as gum and maple.

Although most Eastern Shore forests are hardwood or mixed forest types, loblolly pine is the species that drives most of the local forest economy. Close to 90% of the wood used on the Lower Eastern Shore is loblolly pine. An analysis by a local consulting firm– Parker Forestry Services (PFS)– indicates that mills compete for pine across the whole Eastern Shore. About 18,000 acres per year is being harvested and that is close to the available capacity according to PFS.

The area now covered by Chesapeake Forest Lands supplied as much as 17% of the available annual pine harvest in the past, generating more than $2 million in internal return annually from harvesting about 3,000 acres / year. With multiplied values created by wood manufacturing facilities present in the area, this translates into $42 million in local forest-related outputs. This level of forest-related activity encourages private owners to keep land in forests because it provides reliable income for taxes and other land care costs. Conversely, the loss of such activity opens the field to competing land uses such as development.

The Department of Natural Resources will obviously have management approaches that differ from those of the previous industrial owner. There's likely to be more thinning and less commercial harvest to increase diversity, open up stands and create special conditions for wildlife. There will be more spent on special land treatments, monitoring and demonstration to meet the objective of serving as an example of state- of- the- art forest management.

Providing a level of harvests, even though heavy toward thinning, remains important for supporting a viable forest economy. The ability to sell wood is a major source of income for private owners who hold most of the Eastern Shore land. If markets for forest crops are present, owners have economic incentives to keep their land in forests. If not, they are motivated to look for other uses such as development, and then many key environmental functions of their forests are lost. Such an outcome, over time, could offset many of the environmental benefits of the Chesapeake Forest.

6. People and Forests on the Eastern Shore

Historic Settlement and Forest Use Patterns

The earliest settlers in the region were Native Americans who are thought to have moved to the area between 3500 B.C. and 500 A.D. They were hunters and fishers who also developed agriculture during the later period of their settlement. They made extensive use of fire as a tool for land clearing, ridding areas of brush, brambles, and insects, and providing defensible space around villages. Their fire management practices were an important aspect shaping the development of forest ecosystems, favoring species like pine and oak that have higher fire-tolerance (see above).

The first English settlers arrived in the mid-1600's and were generally trappers and traders who settled along the waterways that provided the main transportation routes. Much of the land was transferred by land grants from Lord Baltimore. Tobacco was a mainstay crop, and was used as a medium of exchange for many years. By the end of the 18th Century, tobacco had depleted soil fertility and the markets were becoming unstable, but the extension of the railroad from Wilmington to the Eastern Shore, as well as the growth of steamboat shipping, opened urban markets for agricultural products such as vegetables, chickens, corn, and soybeans. Timber for boat building was plentiful, and buyers from the North came to the Eastern Shore to purchase pine for masts. The oyster industry thrived around the turn of the 20th Century, increasing the demand for boat-building timber.

The widespread industrial destruction of Maryland's forests began in the 18th Century, when there were estimated to be 17 or 18 iron forges in the state at the start of the Revolutionary War. Records indicate that it took 22 cords of oak and hickory wood a day to make the 800 bushels of charcoal needed to produce two tons of pig iron. One furnace that operated almost continuously for a century, required 10,000 acres of woodland. As cypress swamps and upland forests were logged, more wood was wasted than was used, and the great forests were largely exhausted by 1890.

The conversion of forests to cultivated farmland probably peaked somewhere in the early years of the 20th Century. In a forest inventory conducted during the years 1907 to 1914, Besley (1916) reported the percentages of forest cover for the Lower Eastern Shore counties as: Caroline (30%); Dorchester (37%); Somerset (25%); Wicomico (46%); and Worcester (47%). By comparison, those percentages today are 31, 21, 25, 42, and 38, respectively, indicating that forest cover continued to decline somewhat in the 20th Century.

Fire and its role in shaping the forests of the region

The average pre-European-settlement fire frequency was on the order of 7-12 years for forests of the Eastern Shore of Maryland, with higher frequencies of 4-6 years in the southeastern Maryland counties of Wicomico, Worcester, Somerset, and Dorchester (Frost 1988). These frequencies are high compared to most areas of the Northeast. Since it is unlikely that lightning was a significant contributor to these fires, Native American populations must have been. Pyne (1982) concluded that fire in the Northeast was predominantly a phenomenon associated with human activity.

The forest that covered the Eastern Shore in Indian times was predominantly a hardwood one, though increasingly mixed with pine to the southward (Rountree and Davidson 1997). The large patches of pine-dominated woods today are largely second growth, the result of extensive clearing in historic times. In aboriginal times, the woods of the Eastern Shore were likely to be oak-hickory, oak-gum, or oak-pine types, all of which still exist in second-growth form.

Captain John Smith said in the early seventeenth century, "A man may gallop a horse amongst these woods any waie, but where the creekes or Rivers shall hinder". Father Andrew White wrote that the woods around St. Mary's were so free of underbrush that a "coach and fower horses" could be driven through them (Rountree and Davidson). The open conditions could be partly attributed to the closed canopies of these mature forests, which shaded out undergrowth, but it is also likely that periodic fire helped to maintain the park-like conditions.

Pre-European fire occurrence was probably highest near sites of major Indian settlements or seasonal fire activity. Open woods, when containing large stands of deciduous, nut-bearing trees, must have been the most desirable ecological zone to have near an Indian town. Aside from all the food and other things it has for people, this zone is extremely attractive for browsers like deer and elk (extinct in eastern Virginia and Maryland by about the eighteenth century).

It is reasonable to assume that Eastern Shore tribes also used fire to periodically burn the marshes that were important sources of mollusks, fish, furbearers, waterfowl, edible tubers, and reeds for housing. Fire would have been useful for herding game, enhancing visibility or access, or retarding invasion of woody growth. More often than not, these fires would have spread into adjacent woodlands and, if of sufficient intensity, created the open seedbed conditions conducive to establishment of loblolly pine. Even today the pattern of loblolly pine "islands" and "stringers" in and adjacent to marshes of the lower Eastern Shore is common.

If, as Rountree and Davidson suggest, oaks were the most prevalent species in pre-settlement times, then the possible role of fire in maintaining these forest types must also be considered. Frost stated that "Light, understory fires may have been the norm for millions of hectares of eastern hardwood forest.....". Most oak species are midtolerant to intolerant of shade, indicating that disturbance is desirable to promote regeneration and growth. Furthermore, acorn germination and initial seedling establishment are most successful where light understory burns have scarified the seedbed and reduced competition. The extensive presence of oaks on the Shore was an indicator that low-intensity understory fires were common, either intentionally set by Indians to create "open woods" or drive game, or the incidental result of land-clearing

The displacement of Native American populations by European settlers in the seventeenth and eighteenth centuries may have had surprisingly little effect on the use of fire or the frequency of occurrence. Like the Indians, the settlers used fire to clear land for farming and houses, though the technique might have been felling and burning rather than girdling and scorching, and more area would have been cleared; in any event, the inevitable result was that some fires escaped and burned into adjacent woodlands. Accounts from the colonial period indicate that fire was also used to drive game, facilitate trapping, clear undergrowth for horse travel, enhance foraging opportunities for free-ranging hogs, and even clear the woods of ticks.

Natural stands of loblolly pine (Pinus taeda) became much more widespread around the turn of the 20th Century, particularly in the counties south of the Choptank, largely due to the influence of economic factors. First was the abandonment of agricultural fields as farmers moved to more lucrative jobs in the towns and cities. Loblolly pine is an opportunistic species which found the recently abandoned fields prime sites for reproduction by natural seeding. The second factor was the rise of large-scale commercial lumbering. Steam locomotives, often used to haul logs from the woods, were notorious for throwing sparks along the tracks and starting fires. Both the clearing of the forests by large-scale logging and the subsequent fires resulted in large areas of open, scarified land suitable for pine regeneration. By the middle of the twentieth century, loblolly pine had become the predominant forest cover type in the lower counties of the Eastern Shore.

Recent Population and Development Trends

The Lower Eastern Shore, while remaining largely rural, is within the "gravitational field" of a large (11 million people plus) urban population. The result is fairly rapid population growth, and pressure to convert farm and forest land to developed uses. This is particularly true in Caroline county, which adjoins Sussex county, Delaware, and Worcester county, where beach-related recreation on the Atlantic coast may be the main cause. Wicomico county, location of Salisbury, grew slightly faster than the region's rate between 1990 and 2000, while Somerset and Dorchester on the Chesapeake Bay side, grew much more slowly (Table 7).

Table 7. Population characteristics of MD/DE compared to selected Eastern Shore Counties

STATE	Population 1990	Population 2000	Increase %	Age–19 or less % of total, 2000	Age– 20 to 64 % of total, 2000	Age– 65 + % of total, 2000
Delaware	666,000	759,000	14.0%	26.2%	60.8%	13.0%
Maryland	4,780,750	5,244,450	9.6%	27.9%	60.6%	11.5%
DELAWARE & MARYLAND	5,446,750	6,003,450	10.3%	27.0%	60.7%	12.2%
E. SHORE COUNTIES						
Caroline, MD	27,030	30,600	13.2%	28.3%	58.0%	13.7%
Dorchester, MD	30,230	30,350	0.4%	26.0%	56.9%	17.1%
Somerset, MD	23,440	25,000	6.7%	23.5%	61.3%	15.2%
Sussex, DE	113,800	143,000	25.6%	25.9%	55.0%	19.1%
Wicomico, MD	74,340	83,400	12.2%	29.1%	58.0%	12.9%
Worcester, MD	35,030	43,300	23.6%	23.6%	57.4%	19.0%

Maintaining working forests in an urban-affected region

Urban populations require a constant inflow of natural services, such as food, fibre, and freshly cycled water and air. These needs create economic incentives to use undeveloped land for farming and forestry to produce these goods. But many of the natural services, such as cycling of water and air, or wildlife habitat, are not priced in a market where landowners can be financially rewarded for keeping land in forests. This lowers forest owners' ability to compete as land holders where areas urbanize.

Urbanization also creates large outflows of influence that tend too push land uses such as farming and forestry further away. Used water, air, waste material are exported from the urban areas to cheaper rural land. Farming and forestry and other open space uses are generally out-priced when push comes to shove and a large population center needs to expand or export a problem. The lands then move into higher priced uses that generally feature more houses, more highways and other developed amenities. As those land use changes radiate outward, the industries such as forest products manufacturing experience supply reductions as well as growing urban attitudes that discourage or even legislate against activities like logging, trucking, or manufacturing. Where business leaders sense that the future of the industry is limited, they begin to limit investment in new facilities, and the future of the industry can become locally tenuous.

This situation is clearly affecting the Eastern Shore, and while the Chesapeake Forests can resist the pressures to be converted to other uses due to their conversion to public lands, the management of the lands will be affected by the fate of the private lands around them as well as the future of community factors such as the forest products industry and the pressures for outdoor recreation.

Studies by the Department, using 1997 Census of Agriculture data, indicate that land in the Eastern Shore counties is attracting market prices that are 2-5 times higher than the land's agricultural or forest value. The higher that ratio becomes, the more vulnerable the land is to conversion. By comparison, some Maryland watersheds on the Western Shore close to the Baltimore-Washington corridor have price ratios as high as 10 to 15.

Land prices cut both ways in a situation like this. High prices near the urban areas mean high taxes, and commodity producers are squeezed out of production because they can't afford to pay development-price taxes on farm or forest land. They are then forced to sell to protect their family's asset value. On the other hand, lower land prices in areas adjacent to heavy growth pressures encourage leap-frogging. The Eastern Shore, while not in the immediate high-pressure zone, is close enough to allow developers to think that distance is not as much a problem as price, so they are encouraged to build on the cheaper, more remote lands.

One signal that this leapfrog effect is occurring on the Shore is the informal estimate that there are 20 new golf courses nearing completion in the area, and another 20 on the drawing boards. This is a land use that can pay more for land and taxes than farming or forestry, but less than condos or shopping malls.

Several large resort developments have also just been announced. The fact that these uses are currently expanding in the Shore counties means additional focus on the area as a recreation destination, which spells more visitors, more traffic, and more residential development in the coming decades. Some of this growth will take agricultural land; some will take forests. The future of agricultural land is important to forestry, because as agricultural land gets developed, and agricultural cultural values are replaced by urban values in the region, the pressures against production forestry will mount. That trend is already well underway and seems destined to continue in the future.

In the five Maryland counties where Chesapeake Forest is located, populations are older and less affluent than the averages for their respective States (U.S. Census, 1998). This sets the stage for significant amounts of land turnover, fragmentation, and land use change in the coming decades. And it leads to considerable concern for the future of rural lands as development pressures spread south from Wilmington, east from Baltimore-Washington, and west from the recreational beach resorts.

7. Landscape Considerations

Shifting from Stands to Landscapes

In the past, management of forests was done primarily on a stand-basis, and most of the time, as stands within specific property holdings. From an ecological perspective, the stand was taken as a unit that could be accessed independent of others. Economic considerations, such as the desire to have consistent product to sell from year to year, and to minimize costs of treatments, linked the management of different stands, but otherwise it was assumed that a stand, by definition, was a management unit on which treatments could be scheduled independently of all others.

In recent years, however, there has been a strong movement toward management at a landscape level. Landscape level considerations means that the status of any specific stand, and what forestry treatments are applied to it, depend not only on its internal conditions (stand age and structure, site index, etc.) but on the condition of other stands and of other lands in a region. The landscape-level perspective leads to a view of stands within landscapes. The condition of other stands includes not only their stand age and structure, but the frequency distribution of stands on the landscape of different kinds and stages. Landscape considerations also take into account land holdings by other land owners and government agencies. The management of a stand is perceived within a regional context.

All of the major goals of this project need to be examined from a landscape-level perspective, and decisions made in light of this perspective. Among the factors that are leading in the direction of management from a landscape level perspective are: the requirements of the Endangered Species Act; the Clean Water Act; the habitat needs of migratory species that make use of forest stands; the habitat needs of game species and other species of recreational value; the perception that recreational uses can benefit from a variety of stand types, not just from the existence of a certain kind of stand.

There are a number of examples that illustrate the landscape perspective. Recent approaches by Boise-Cascade illustrate landscape level forest management as a result of concerns with endangered species. Boise-Cascade has holdings in the southeast that are habitat of the Red-cockaded woodpecker. The company has taken the position that, while it can affect habitat for this species within its own holdings, it cannot be held responsible for the status of the species, specifically for the population abundance of the woodpecker. Instead, Boise-Cascade has initiated voluntary, cooperative agreements with other land-holders and with government agencies so that planning for forest use is done on a regional basis. In this case, the decision about how a specific stand will be treated is influenced by more than the condition of that stand, and more than the holdings of Boise-Cascade. That treatment depends on the availability of habitat for the woodpecker in an entire region, and, by voluntary action, the corporation chooses to harvest stands under its own control to meet the regional needs of the endangered or threatened species, as well as to meet its corporate needs.

Similarly, the desire to have clean water leads to a consideration of water quality within a region, as well as within a specific ownership. On the Eastern shore of Maryland, drainage is complex, with many areas affected by tidal influences, and, during periods of high water following storms, drainages may shift direction of flow, or flood, or water from different watersheds might mingle. Water quality is affected by the condition of water in the bay, on lands that are in agriculture and housing, as well as on the forest land, making clean water a landscape

Thus a landscape-level perspective is intrinsic, if generally unspoken, in forest planning on the Eastern Shore, and is likely to become increasingly important in the future. As the experiences and practices of Boise-Cascade illustrate, this level of planning and management can be done on a voluntary, cooperative basis, and be driven by market forces. Landscape-level planning means that a stand is seen within a regional context, but this does not require that planning be done from an external or regulatory perspective.

Watersheds as a Landscape Issue

Concern for some of the resource management activities on the Eastern Shore stems from the regional attention to water quality in the Chesapeake Bay and its tributaries. Declining water quality in the Bay has resulted in major interstate efforts, many of which have identified the treatment of the land within the watershed as the primary factor in reversing the decline and restoring the Bay's aquatic environments.

In its Clean Water Action Plan, the State of Maryland identified 138 "8-digit" watersheds, averaging about 75 square miles each, as the unit of analysis most suited to identification of watershed condition and treatment priorities. The "Unified Watershed Assessment Report" published by the State evaluated clean water and other natural resource goals on these watersheds. The clean water goals were based largely on the State's biennial water quality report, prepared in response to Section 305(b) of the Federal Clean Water Act. Waters that were reported to have violated water quality standards were assigned to "Category 1," as "in need of restoration." In addition, watersheds that were not in violation of water quality standards, but which were shown to need restoration in order to meet two or more natural resource goals, are also placed in Category 1.

Category 2 watersheds are those that meet current water quality and natural resource goals, but need preventative actions to sustain existing water quality. Category 3 are high quality pristine watersheds where protection was a high priority. In selecting water quality indicators that might be most affected by forest management within the watersheds, we chose nutrient loading. See chapter 3, section 4 for additional characterization of Watersheds on Chesapeake Forest.

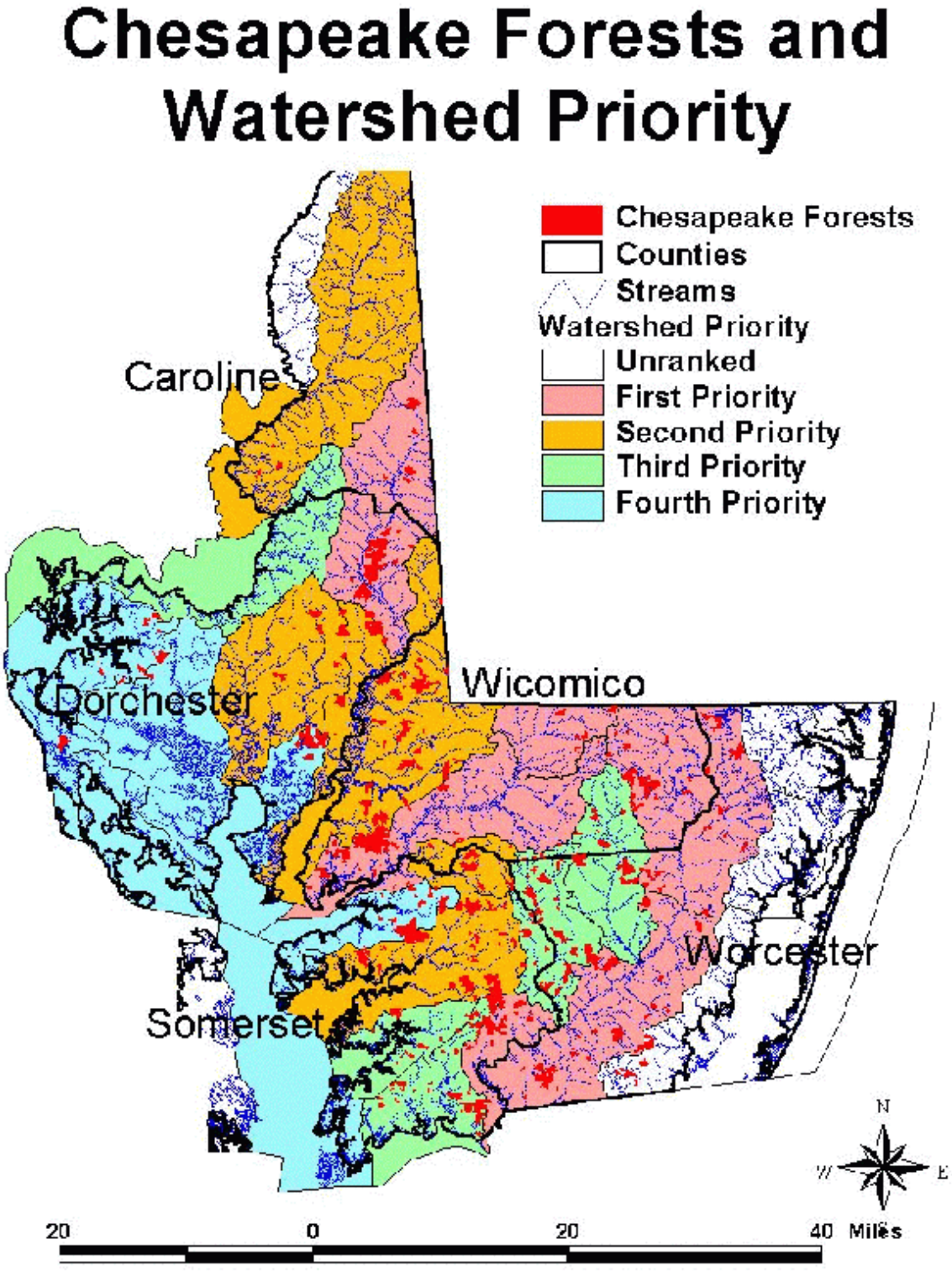

Figure 8. Watersheds on Maryland's Lower Eastern Shore, illustrating priority levels for restoration.

8. Water Quality Issues

Chesapeake Forest Lands play a pivotal role in water quality on the lower Eastern Shore. Forestlands provide a steady source of clean water to streams and tributaries. Forests act as nutrient sinks across the landscape, absorbing more nutrients than they supply. Additionally, as has been illustrated in the Regional Settings section, Chesapeake Forest Lands contain a substantial amount of the industrial forestlands on the lower Eastern Shore and therefore are critical to the viability of the timber industry and consequently, the forest cover in the region. Without the infrastructure of the timber industry, forestlands may be converted to other more polluting land uses. Finally, the location and landscape position of Chesapeake Forest provides opportunities to capture additional nutrients and sediments traveling across the watershed

Nutrients are the largest water quality concern on the lower Eastern Shore due to their negative impact on the Chesapeake Bay and its tributaries. Based on the water quality model used by the US EPA Chesapeake Bay Program, forests supply 12% of the nitrogen and 1% of the phosphorus to the tidal streams of the watershed where the Chesapeake Forest lands are located. Although agricultural sources are clearly the largest source of nutrients on the lower Eastern Shore, forests still supply a substantial amount of the total nitrogen entering tidal waters because of their extent in the region. In terms of per-acre contribution, forests supply far less nitrogen than they receive from atmospheric deposition. Forests are estimated to contribute only 2 pounds of nitrogen per acre per year at the same time that they are receiving 9.5 pounds of nitrogen per acre per year from the atmosphere. See Chapter 3, section 3 for additional characterization of water quality

9. Potential Water Quality Impacts of Forestry Operations

Timber operations have the potential to create unacceptable impacts on water quality. However, with proper best management practices, these impacts are generally minimal and temporary. While the low relief of the Delmarva coastal plain reduces the risk of causing significant water quality impacts, it also increases the occurrence and therefore the exposure of aquatic systems, and thereby reduces the opportunity to mitigate any impact that does occur. See chapter 5, sections 3 & 5 for additional information on mitigating impacts from forestry operations.